AENSI Journals

Advances in Environmental Biology

ISSN-1995-0756 EISSN-1998-1066

Journal home page: http://www.aensiweb.com/aeb.html

Applying Environmental Knowledge Management Through EKCP

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ARTICLE INFO

Article history:
Received 2 April 2014
Received in revised form
13 May 2014
Accepted 28 June 2014
Available online 23 July 2014

Key words:
Environmental Knowledge Cycle Process (EKCP), Knowledge Management, Environment Management, Environmental Knowledge Management.

ABSTRACT

Environmental knowledge management contributes the sum of advantages of environmental management and knowledge management and in the near future will become the prevalent tool for business. Environmental knowledge management integrates the environmental issues with environmental daily activities with the goals for decreasing environmental pollution as well as increasing companies' concerns and responsibilities about the natural environment. Tatsuki & Masahisa (2006) expressed that knowledge management can solve environmental issues in an efficient way. They found that collected data and information from environmental projects can be ordered and organized for knowledge management system and can be used for to solve environmental problems. Environmental knowledge management integrates the implicit knowledge from employees' experience and explicit knowledge from environmental duties in regard with making efficiency of team work better and solving environmental problems. This issue not only decreases pollutant emissions from production processes, but also causes increasing prevention and avoiding environmental pollution. In this study, having investigation successful firms in the context of knowledge management; management of environment and environmental knowledge management, a framework for environmental knowledge cycle process (EKCP) in the firms have been proposed. In the regard of this purpose, relevant published papers in this context from 1980 have been reviewed. In fact, firms with efficient environmental knowledge cycle process not only can continuously empower green knowledge capital and its international competitiveness, but also this process causes green business opportunities for firms and environmental sustainable development.

To Cite This Article: Leila Sepahvand and Reza Sepahvand., Applying Environmental Knowledge Management Through EKCP. ***Adv. Environ. Biol., 8(11),*** *127-134, 2014*

INTRODUCTION

Environment and natural resources are the suppliers of many production inputs. Production process more over has the desirable outputs (consumable goods), also has the undesirable outputs (environment pollutants). If, this output was not controlled and was inappropriate, harms driven from undesirable output would be more than desirable production benefits, so that costs driven from damages inserted to the environment can cause non-compensable harms and sustainable development would face the serious challenge [2]. So as, to solve pollution problems, environmental management and supply chain management are vastly applied by firms with goals like pollution decrease and environmental performance evaluation [3,4,5]. Environment protection and performance have become two first priorities of sustainable development achievement [6]. During the last decade, environmental management has moved from the controller approach to the approach emphasizing in sustainable development. Knowledge management also has been progressed during the last decade. Literature review shows that at first theoretical researches have been proposed and gradually its application in identifying and solving various problems was increased. Environmental knowledge management also has been defined as the system to connect and analyze data and people who create a chance for recognition industrial ecology in the business environment [7]. Data collected from one project have not usually much paid attention in the unread reports and secret systems and is forgotten or is lost by transformer employees. Failure in transferring knowledge leads to waste activities and harm organizational performance. Intangible resources can create competitive advantage and cause crediting the transparent factors. Knowledge potentially creates competitive advantage for all businesses [8]. So that firms, with applying environmental knowledge management and considering criterion of maximizing net benefits of pollution, in one hand cause benefiting advantages driven from thrift and in another hand cause maximizing company's profitability creating innovation in designing and producing productions

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consistent with environment and having recycling capability. However, key aspect of environment management success is influenced by knowledge management which proposes the computer-based and organized environmental knowledge management system to all of employees in all levels in the organization in order to enable employees to gain environmental awareness and be responsible for environmental decisions about the business. In this study, at first conceptions such as environmental management (EM), knowledge managements (KM) and environmental knowledge management (EKM) have been studied and in the following, environmental knowledge recycle in the firms has been regarded.

Environment management:

Today, with increasing environmental issues such as energy crisis, natural resources' waste and destruction and increasing wastes resulting from urbanization and industrial development, the human impact on the environment has been paid attention by researchers. Because they consider many of defect resulted from direct or indirect consequences of human behavior [9]. In Petak's viewpoint [10], environmental management is to control human activities in order to achieve acceptable balance between quality of human environment and quality 0f natural resources. Environmental management is also applied to gain balance between environment, ecologic protection and economic situation. Based on Lorrain Smith [11], control factor has to be added to the environmental management. So, he defines the environmental management as following: an activity has been done by the society and a part of organization or society makes the environmental quality better with developing and implementing plans and using continuous reviewing. Conceptions of pollution control are proposed after creation of issues and problems relevant to the pollution. US environmental protection agency and pollution prevention project define the pollution prevention as decreasing in production resources, material substitution and effective processes on prevention from different kinds of pollutants at the beginning of production process. From 1995, environmental management is applied to improve environmental sustainable development [13]. Balance between economic development, social rights and continuity in using natural resources has to be maintained [14]. as it was mentioned before, it is transparent that in the recent years, various improvements in the context of environmental management have been emerged through improvement in controlling pollutant effective on practice beginning.

Knowledge management:

Knowledge is the most powerful engine of production [15]. In the modern economy, strategic resource knowledge is considered as industrial and economic development and other traditional factors such as ground, human force and capital stand in the next importance orders. New technologies give the organization this opportunity to apply knowledge management systems to save and propagate unstructured information. Knowledge based on the organization's borders is divided into internal and external parts. Access to the external part is important for the organizations due to two reasons: first of all, to establish knowledge and second of all, to prevent learning challenges based on overreliance on internal knowledge [16]. Since an organization's input and outputs is knowledge, acquiring, refining, storage, and sharing knowledge constitutes the major part of an organization's activities. So, the underlying question of the organization in the competitive environment is to apply knowledge management in information organizing and on the process knowledge in order to manage its collecting and reorganize this process in the systematic form and with its analysis, organizations achieve more valuable contents. Knowledge management and its policies are necessary, because in this process, individual knowledge is not accumulated, but also latent knowledge of people is manifested and enriched [17]. Davenport& Prusak have defined the knowledge as the combination of experience, values, data and experts' vision which proposes a framework to evaluate and integrate new experience and data [18]. Therefore, knowledge as the major invest of the organizations causes creating a new issue entitled "knowledge management" [19]. Knowledge management is defined as the process of identification, creation, acquisition and applying organizational knowledge in order to benefit new opportunities and progress organizational performance [20]. Most prevalent definition for knowledge management has been proposed by US Quality and Productivity Center. It is defined as "known strategies and processes, knowledge ranking and acquisition" [21]. Wei-Tsong [22] also believes that knowledge management is a process that is applied by organizations via their collected information.

Environmental knowledge management:

Ideas relevant to the sustainable development have been proposed in Bernadet's report [23]. The combination of environmental management and knowledge management is an integral part of achieving sustainable development. Wenger [24] indicated that firms having common environmental strategies in the context of pollution prevention and their economic and environmental performance are more transparent, have more stability in the competitive market. However, the way that knowledge management and environmental management are combined and are applied in the real situations is the entire new issue. Organizational knowledge is formed in the interaction between technologies, techniques and employees. Organizational

knowledge is usually divided into implicit and explicit knowledge [25]. Explicit knowledge can be written; transferred and shared [26] and be saved in the knowledge resources. Samples of explicit knowledge are data bases, directories, papers, speeches, organizational modern methods and other similar documents [27]. For the first time, Michel Poolani developed the implicit knowledge conception. In his belief, implicit knowledge is a kind of personal area and guarantees crosses between the individual and culture which belongs to [28]. This kind of knowledge is has the complicated and non-transparent nature, so its transferring is not easily and immediately being occurred. Close relations via continuous relationship and interaction help sides to formally and informally interact information and in another hand, it is changed to the common conceptions and expressions through frequent discussions between members of the two companies [29].

Therefore in the organization, environmental knowledge management is the combination of explicit and implicit knowledge management and applying environmental knowledge. Environmental impacts of production activities are controlled by environmental knowledge management through establishment, collecting, sharing and applying environmental knowledge. Environmental knowledge is a kind of public knowledge which consists of conceptions relevant to the environment protection, ecosystems and natural environment [30]. Environmental knowledge includes people awareness and their concerns about natural environment and their responsibilities toward environmental protection and their awareness from relation between economy and sustainable development. People having environmental knowledge while facing environmental problems, know what to do and are familiar with advantages and benefits of environmental responsible practices [31]. Current business trend moves toward using knowledge management and environmental knowledge management and governments and organizations emphasize these conceptions. Environmental knowledge management integrates the environmental issues with organizational daily activities with the goals for decreasing environmental pollution as well as increasing companies' concerns and responsibilities about the natural environment.

Difference between environmental knowledge management and environmental management information system (EMIS)

EMISs are the most important part of the environmental management which helps the environmental and non-environmental managers to do their duty properly. In total, EMISs are the computer based technologies which support the environmental management systems Eagan & Finster [32] have defined the environmental knowledge management systems as following: a system constitutes tools, mechanisms, processes, structures, people, policies, strategies, data and information which are able to creation, acquisition, saving, collecting, retrieval, applying and transferring knowledge and cause progress in multi aspect effects of the organization on the environment. Therefore, EMIS is the specific part of environmental knowledge managed, but can't be indicated as its whole part.

Environmental knowledge cycle process (EKCP):

Lee *et al* [33] measured the knowledge management as the use of knowledge cycle process. This process includes 5 stages: knowledge creation, knowledge acquisition, knowledge sharing, applying knowledge and knowledge internalization. According to knowledge cycle process (KCP) which has been mentioned, in this study applying environmental knowledge cycle process (EKCP) in firms has been investigated. EKCP consists of 5 parts: environmental knowledge creation (EKC), environmental knowledge acquisition (EKA), environmental knowledge sharing (EKS), environmental knowledge utilization (EKU) and environmental knowledge internalization (EKI). Firms utilize the EKCP to transform external environmental knowledge to the firms' internal values to increase employees' responsibility toward environment and sustainable development. To achieve this purpose, environmental issues become the values and cultures in the company [35,36]. Firms' trend to green innovations will increase influenced by competitive market's pressure. Companies only through using environmental knowledge management are able to stay in competition with other companies to increase income and maintain competitiveness in international level in the context of sustainable development. As a result, implementing environmental knowledge cycle process not only improves the financial and environmental performance of the company, but also decreases the water pollution and the firms' total energy consumption.

Components of environmental knowledge cycle:

Environmental knowledge cycle process constitutes the frequent activities in the environmental knowledge area and is implemented in EKC, EKA, EKS, EKU, EKI stages. Knowledge management is the need perception to the development of newer systems and technologies about the creativity and competiveness [37]. A model by "Nonaka" and "Takeuchi" has concentrated in two kinds of implicit/explicit knowledge and has regarded how they turn to each other and its creation in organizational levels (individual, group and organizational). In this static model, how to use and convert these 2 aforementioned kinds of knowledge and their knowledge management in the spiral (helical) movement and also in the continuous process have been assumed. Based on this model, following stages are done to transfer (convert) knowledge in the various levels of the organization:

- Socializing (implicit knowledge to the implicit knowledge) : intangible knowledge transfer of an individual to another one.

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- Outsourcing (implicit knowledge to the explicit knowledge) : converting intangible knowledge to the tangible one. In this circumstance, a person can propose his knowledge to others in discipline content form (seminars, workshop). Conversation among members of one group in the response to the questions or inference from occurrence is such usual activities in which this kind of conversion happens.
- Combination (explicit knowledge to the explicit knowledge) : in this step, movement from personal tangible knowledge to the group tangible knowledge and its saving is happened and due to use of current knowledge, the possibility to solve problems via groups is provided and subsequently knowledge is developed.
- Internalization (explicit knowledge to the implicit knowledge) : in this step, obtained tangible knowledge is institutionalized in the organization. Also, passing this step will be followed by emerging personal new implicit knowledge for the people [38,41]. Environmental knowledge cycle process based on Nonaka & Takeuchi's model has been shown in Fig 1.

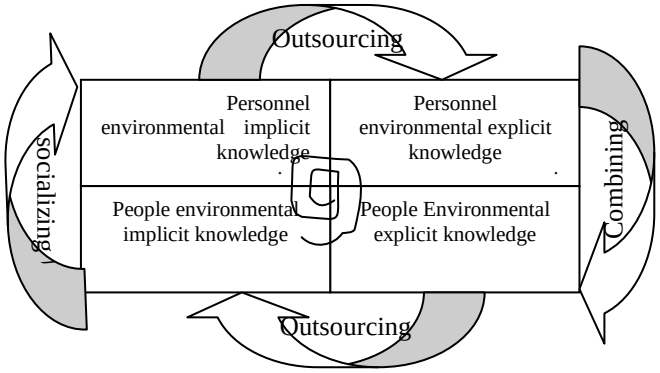

Fig. 1: Environmental knowledge cycle process based on Nonaka & Takeuchi's model.

2 important ways to acquire environmental knowledge has been tested and experienced. From Manbagera's viewpoint, technologic knowledge, employees' experience and skills are the valuable invests which are collected in the firm by the time and are fitted in the organizational culture. Dierickx & Cool [39] mentioned that organizational strategic evaluation saves the integrated collected resources in one time duration. Though, knowledge saving is usually governed by a specific person [40], so environmental knowledge acquisition needs continuous attempts to achieve employees' experience and high allocation of organizational resources. Environmental knowledge sharing also is one of the various kinds of activities related to the knowledge among people and groups in the organization. Internalization of the environmental knowledge is the learning process via explicit and tangible knowledge conversion to the implicit knowledge [41]. Employees can access environmental information and knowledge required to complete their duties through a series of environmental seminars and meetings. Environmental knowledge cycle process is a continuous process which continuously increases insurance to obtain competitive advantage by environmental management creation, acquisition, sharing, utilization and its internalization.

EKCP steps in the firms:

- *Environmental knowledge creation:*

When people distinguish and develop the new ways of doing things, knowledge is created; environmental knowledge management system is the complete and user-friendly information system which consists of a great deal of information in the context of environmental knowledge. Through it, employees can search E-learning courses and required data in the internal database of the firm. Environmental policies and external environmental information are provided for the employees through firm's environmental website and intranet. Company can access information via its employees' interactions and communications with people out of the firm, hiring previous staffs of component company and also through public references such as presented reports in the conferences, journals, books and registered inventions and reproaches in one industry [42]. Out of environmental knowledge management system, environmental engineers related to the internal levels of the organization can access to those kinds of environmental information and experience which can't acquire via surfing in the net through senior environmental engineers (implicit knowledge). In this regard, companies provide chances for research about the knowledge of environmental preservation and new technologies out of borders. Under EKM system, authorities provide employees challenges consistent with abilities, job features, job complexities and specialty. Environmental engineers responsible for environmental practices in the company need the entire perception of environmental knowledge. For example, engineers responsible for preventing weather pollution have to:

- Study policy of weather pollution prevention.

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- Take the educational plans for the certain time.
- Try to be professional in the context of management of prevention from weather pollution and acquire related licensee.
- Have the full perception of conceptions related to the knowledge management and apply them to prevent and control pollution.

Firm has to found the environmental protection department (EPD) separately and outside the company which is responsible for EKM and environmental issues and is supported by top managers. This part increase firms' awareness about EKCP. Changes in the firm's organizational primary structure empower this department in the field of resource integration and saved energy. EPD usually holds brain storming meeting to acquire information, knowledge and environmental structured recommendations. After holding regular brain storm meetings, engineers of EPD will find the ability to accept new challenges to create new environmental knowledge in regard with producing modern technology to decrease pollution and apply it in the new works. Environmental engineers while facing environmental issues, kook for recommendations and solutions through societies. Therefore, professional environmental knowledge is easily published through systematic knowledge of societies and electronic learning system which are built by professional senior engineers.

- *Environmental knowledge saving:*

When engineers of job Health and safety department, industrial safety and environmental protection encounter a hard problem or similar issue happened in the firm before, search the required information or experts' experiences from different databases, societies and environmental knowledge bases of the company. So, environmental knowledge system must be continuously improved and moves toward computer-based and paperless system. Engineers of EPD uses safety audit system as the pattern to describe how information and knowledge required for achieving environmental goals are searched via environmental databases. Therefore, firm should have continuous monitoring and auditing and update firms' internal information system using this information. In this way, educational information for the future use is formed and built knowledge increases the advantages of knowledge management. Environmental knowledge is achieved via learning and is saved in the environmental directory. Also, it is shared after completing projects of pollution prevention or projects of environmental management. Implicit knowledge has become explicit knowledge and is saved as electronic files and directories. In the field of environmental knowledge and information acquisition, company should implement environmental education and provide employees a great deal of information through educational courses downloaded from the internet.

- *Environmental knowledge sharing:*

Knowledge sharing includes sharing information, ideas, recommendations and experts' judgment related to the organization among all employees in the organization. This interaction can be informally happening in the places like saloons and formally in the meetings, seminars and presentations [43]. Knowledge sharing in the companies can be ranked as the following:

- The newest information: firm shares the newest information in the seminars and conferences.
- Special information for the specific person or situation: different environmental knowledge and information are sent to the specific individual and place as documents and electronic posts.
- General information: This information is located on the electronic signs to be used by all staffs.

Firms' environmental knowledge and information are shared by external and internal teams and through documentation, holding seminars, conferences, and expert employees' involvement in the education and providing proper situation for more interaction among employees [44] in order to make employees more interested to participate in the environmental obligations encouraging their employees. For example, information of pollution control and environmental protection are propagated via conferences and the goal for improvement in environmental knowledge sharing process and achievement firm's environmental goals. About external teams, firm exchanges the experts' opinion and environmental knowledge sharing with other companies. About skills and techniques of environmental protection and issues of industrial safety, nothing has to be left. Firm is responsible for social and environmental responsibility. It has to implement environmental infrastructures and steps toward achievement global sustainable development with integration of resources.

Firm should increase descriptive information of databases. So that, each systematic file is defined as a data in the range of system knowledge database. This descriptive information which includes content description, file size, author, publication date and file place and address. In fact, a data management system is effective when it changes with different kinds of data, usage condition and file contents. Using descriptive information increases system's speed and empowers the researchable file and common environmental knowledge. Nevertheless, document safety has been paid attention a lot and this safety is guaranteed during knowledge sharing process.

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- *Environmental knowledge utilization:*

Knowledge utilization is the effective use of knowledge [45]. In environmental knowledge management, electronic exchange system has been applied. One precise environmental knowledge management system provides this possibility to do environmental duties easily. Moreover, involvement in environment practices relied on using environmental knowledge in the company will lead to the environmental performance improvement. In this regard, firm must consider encourages such as giving goods, specific prizes and cost for innovations for employees who have a proper performance in the context of maintaining and keeping environmental knowledge and protection.

- *Internalization environmental knowledge:*

Firm has to provide directories and catalogs to improve employees' job knowledge. These resources provide this possibility to increase employees' perception from their job and skills. Above all, some parts of the firm download environmental period information from the internet and some other parts also use courses related to the environment to make employees' ability better and increase the sense of environmental responsibility. Under monitoring of environmental protection department and to help doing environmental duties, environmental information and references system is established. Professional information system is continuously revised and updated to provide this possibility for the employees to look for environmental information and collect knowledge via systems which can complete their new environmental duties. Through these processes, employees can internalize their tangible and explicit knowledge as the implicit knowledge and acquire environmental awareness. Utilizing environmental knowledge information system increases the sharing speed and internalizing environmental knowledge. External strategies like environmental policies, environmental awareness, green innovations, social responsibilities and continuous monitoring of the firm's environmental protection department speed up firm's environmental knowledge management improvement. Environmental knowledge cycle process (EKCP) in the firm has been shown in the Fig 2.

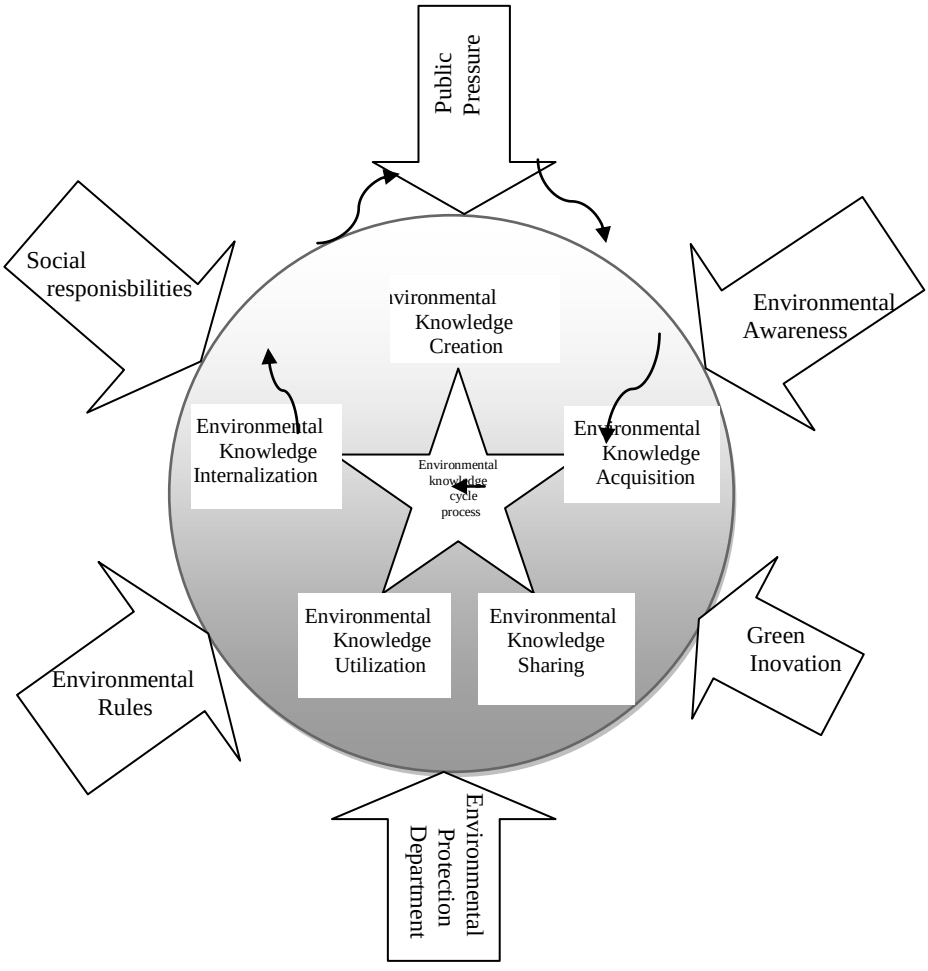

Fig. 2: Environmental knowledge cycle process.

Discussion and conclusion:

Environmental problems driven from waste repulse in the production process is complicated, but despite of this complexity, it can be overcome. For this purpose, input references and materials, output goods, waste materials and effects must be clearly defined. To solve this kind of issues, firm has to combine the collective production and environmental management system in line with continuous development of technologies and pollution prevention during production process. This process in fact is considered a sample of environmental knowledge management performance and environmental knowledge management is developed via environmental knowledge cycle process. Because this cycle improves the environmental performance and it is along with many advantages through environmental knowledge management. Environmental knowledge management is the continuous environmental practice which includes creation, acquisition, sharing, utilization and internalization of environmental knowledge. It helps companies to prevent from environmental occurrence; establish the green technology and develop green productions. Above all, environmental knowledge management helps managers to identify the best investment projects to achieve goals of sustainable development. Information sharing is the basis for creating and utilizing the methods of development and improvement of new technologies designing environment friendly production. Creating new technologies of the firm causes the firm plays a leader role in the field of green productions and green technologies development compared with companies which produce similar productions.

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